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IS 15224 (2002): Laying of Plastic Translucent Sheets Made from Thermosetting Polyester Resin (Glass Fibre Reinforced) Alone or in Conjunction with Asbestos Cement Sheets/Steel Sheets/Aluminium Sheets - Code of Practice [CED 5: Flooring, Wall Finishing and Roofing]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

तापहृढ़ पोलिएस्टर रेजिन (कोंच रेशा प्रवलित) से बनाई गई
प्लास्टिक की परभाषी चद्दरों को अकेले अथवा एस्बेस्टोस
सीमेंट चद्दरों/इस्पात चद्दरों/एल्यूमिनियम चद्दरों के
साथ बिछाना — रीति संहिता

Indian Standard

LAYING OF PLASTIC TRANSLUCENT SHEETS MADE
FROM THERMOSETTING POLYESTER RESIN
(GLASS FIBRE REINFORCED) ALONE OR IN
CONJUNCTION WITH ASBESTOS CEMENT SHEETS/
STEEL SHEETS/ALUMINIUM SHEETS —
CODE OF PRACTICE

ICS 83.140.10

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by Flooring, Wall Finishing and Roofing Sectional Committee had been approved by the Civil Engineering Division Council.

For providing structural surfaces exposed to weather, such as roofs of industrial, institutional, commercial, recreational and residential buildings as well as for providing daylight; plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) are laid either fully or partially (where the roofs are laid using asbestos cement/steel/aluminium) in chequerboard or cover to ridge layouts in conjunction with asbestos cement sheets/steel/aluminium sheets.

This code covers recommendations for laying plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) conforming to IS 12866 either fully or partially in chequered or caves to ridge layouts in conjunctions with reinforced corrugated asbestos cement sheets conforming to IS 459, corrugated galvanized steel sheets conforming to IS 277 or corrugated aluminium sheets conforming to IS 1254.

The composition of the Committee responsible for formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

LAYING OF PLASTIC TRANSLUCENT SHEETS MADE FROM THERMOSETTING POLYESTER RESIN (GLASS FIBRE REINFORCED) ALONE OR IN CONJUNCTION WITH ASBESTOS CEMENT SHEETS/ STEEL SHEETS/ALUMINIUM SHEETS — CODE OF PRACTICE

1 SCOPE

This standard lays down the method of laying and fixing plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) either fully or partially in chequerboard or eaves to ridge layouts in conjunction with corrugated asbestos cement/steel/aluminium sheets used as coverings for roofs and walls to provide daylight.

2 REFERENCES

The Indian Standards given at Annex A contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated at Annex A.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Abutment — Sloping intersection of a roof surface with a part of the structure which rises above it.

3.2 Accessories — Purpose made fittings such as ridge capping, ridge finials, apron flashing pieces, eaves filler pieces, barge boards, expansion pieces, ventilators, skylights and similar fittings, with which the roof is furnished.

3.3 Apron Flashing Piece — Flashing, the lower edge of which is lapped over the roof covering.

3.4 Eaves — The lower edge of an inclined roof.

3.5 Eaves Filler or Closure Piece — Plastic translucent accessory made from thermosetting polyester resin (glass fibre reinforced) or asbestos cement/steel/aluminium accessory used to fill or close the corrugation spaces under the roof sheeting at the eaves.

3.6 Finial or Ridge End — Plastic translucent accessory made from thermosetting polyester resin (glass fibre reinforced) or asbestos cement/steel/aluminium accessory to form waterproof covering at the end of a ridge.

3.7 Gable — Part of a wall above the general eaves level at the end of a ridged or partially hipped roof.

3.8 Gutter — Any form of roof water channel.

3.9 Hip — Raking salient angle formed by the intersection of two inclined roof surfaces.

3.10 Hip Ridge or Capping — Plastic translucent accessory made from thermosetting polyester resin (glass fibre reinforced) or asbestos cement/steel/aluminium accessory used to form waterproof covering to a hip.

3.11 Mitre — Cutting the joining surfaces of two sheets at an angle.

3.12 Pitch — Angle of inclination with the horizontal of the rafters or substructure surface on which the roof covering is laid.

3.13 Ridge — Line of intersection of two inclined roof surfaces at the apex of a roof.

3.14 Ridge Capping — Plastic translucent accessory made from thermosetting polyester resin (glass fibre reinforced) or asbestos cement/steel/aluminium accessory used to form a waterproof covering to a ridge.

3.15 Valley — Re-entrant racking angle formed by the intersection of two inclined roof surfaces.

3.16 Verge — Free edge of roof surface finishing at a gable.

3.17 Daylight Factor — It is the unit of measure used in daylight design. This factor is the percentage of light which is available inside a building compared to that simultaneously available out of doors.

4 NECESSARY INFORMATION

4.1 For the efficient planning and execution of the work, detailed information with regard to the following is necessary:

- a) Roof area to be covered,
- b) Required daylight factor,
- c) Details of sub-structure of roof (to be designed based on wind loadings),
- d) Pitch of the roof, and
- e) Location and size of openings and details of roofing accessories.

4.2 All the information stated in 4.1 shall be made available by the appropriate authority responsible for the construction of the whole building to those who are entrusted with the work of roof sheeting before the work is started. Necessary drawings and instructions for preparatory work shall also be given where required.

4.3 Arrangements shall also be made for the proper exchange of information between those engaged in laying the roof covering and all others whose work will affect or will be affected.

5 MATERIAL

5.1 Plastic Translucent Sheets

Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) shall conform to IS 12866.

5.2 Fixing Accessories

Fixing accessories, such as hooked, cranked, 'U', 'J' and square bend hook bolts, L-bolts, roof washers, etc, shall conform to IS 730.

5.2.1 Coach screws shall conform to IS 1120.

6 DESIGN CONSIDERATIONS

6.1 Plastic translucent sheet made from thermosetting polyester resin (glass fibre reinforced) are laid either wholly or partially in chequerboard or eaves to ridge layouts in conjunction with asbestos cement/steel/aluminium sheet used as covering for roofs and walls to provide daylight. In order to obtain a structurally sound and permanent roof with adequate daylight and maximum economy, the following requirements shall be followed.

6.1.1 Roof Plan

The roof plan shall be as simple as possible. Formation of hips and valleys should be avoided as far as possible. Isolated projections above roof should be avoided at the design stage itself, as it is difficult to make the

junctions between such projections and the roof sheeting weatherproof.

6.1.2 Pitch of the Roof

The pitch of roofs shall, wherever possible, be preferably not less than 18°. Should it however be found desirable to adopt roofs with a pitch less than 18°, the values prescribed in 6.1.6 for the end laps between adjacent sheets shall be correspondingly increased and/or the joints suitably sealed in accordance with the manufacturers recommendations or the instructions of the engineer-in-charge.

6.1.3 Purlins/Rails

All purlins/rails shall be in one plane and shall be properly anchored to the supporting structure. Special care shall be taken that the sheets do not deflect at the intermediate purlins/rails in an attempt to make the sheets bear on such purlins/rails.

6.1.3.1 When plastic translucent sheets made from thermosetting polyester resin are laid wholly for providing roofs of industrial, institutional, commercial, recreational and residential buildings, it is not practical to give standard support centres and fixing specifications since wind loads are likely to vary from location to location. Factors which should be considered when determining support centres and fixing specifications are:

- a) Sheets should not pull over fasteners when subjected to high wind gusts.
- b) Deflections between supports caused by high wind gusts should be limited to span/15 and never more than 100 mm to prevent fixing holes ovaling and tearing around fasteners.
- c) When subjected to superimposed loads; deflections should be limited to span/30 and not more than 50 mm to prevent laps opening and damaging sealants.

However, the maximum recommended support centres of different profile depth plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) conforming to IS 12866 are given in Table 1.

6.1.3.2 Spacing of purlins/rails

While fixing plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, the spacing of purlins/rails shall be arranged to suit the standard lengths of sheets but shall not exceed the maximum recommended purlins/rails centre as described in Table 2.

Table 1 Maximum Recommended Purlin/Rail Centre for Laying Roof Fully with Plastic Translucent Sheets Made from Thermosetting Polyester Resin (Glass Fibre Reinforced)
(Clause 6.1.3.1)

All dimensions in millimetres.

Type of Sheets	Profile No.	Depth of Corrugation	Pitch of Corrugation	Maximum Recommended Purlin/Rail Centres
(1)	(2)	(3)	(4)	(5)
Corrugated asbestos cement profile in accordance with IS 459	1	48	146	2 250
	2	45	338	2 250
Corrugated steel profile in accordance with IS 277	3	17.5	75	1 250
	4	12.5	75	1 250
Corrugated aluminium sheet profile in accordance with IS 1254	5	19	75	1 250
	6	38	125	2 250
	7	38	190	2 250

Table 2 Maximum Recommended Purlin/Rail Centre for Fixing Plastic Translucent Sheets Made from Thermosetting Resin (Glass Fibre Reinforced) Partially in Chequerboard or Eaves to Ridge Layouts in Conjunction with Asbestos Cement/Steel/Aluminium Sheets
(Clause 6.1.3.2)

All dimensions in millimeters.

Type of Sheets	Profile No.	Depth of Corrugation	Pitch of Corrugation	Maximum Recommended Purlin/Rail Centres
(1)	(2)	(3)	(4)	(5)
Corrugated asbestos cement profile in accordance with IS 459	1	48	146	2 450
	2	45	338	2 450
Corrugated steel profile in accordance with IS 277	3	17.5	75	1 375
	4	12.5	75	1 375
Corrugated aluminium sheet profile in accordance with IS 1254	5	19	75	1 375
	6	38	125	2 450
	7	38	190	2 450

6.1.3.3 When a roof is being laid totally with plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced); the ridge purlins shall be so fixed from the apex of the roof that main sheet fixings should not be located less than 50 mm from ends of sheets. Whenever plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) are laid in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, ridge purlins shall be fixed at the same distance from the apex of the roof as governed by the respective code of practice for laying asbestos cement/steel/aluminium sheets.

6.1.4 Whenever a roof is being laid either by using plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) fully or by using them in conjunction with asbestos cement/steel/aluminium sheet either in chequerboard or eaves to ridge layouts, additional trimmers or bridging shall be used between purlins at all points where considerable roof traffic is likely to occur, for example, adjoining valley or box gutters, below glazing and around chimneys, ventilators or other uptakes. Similarly, when a course of sheets of smaller length is required to make up a roof slope, the closer purlin spacing necessary for to make up a roof slope, the closer purlin spacing necessary for such sheets should be arranged at eaves rather than at edges, as this will bring additional support where it is most required.

6.1.5 Hip and valley runners provided should be fixed flush with the top face of purlins and spanning between them to give adequate support to the raking cut edges of roof sheets at hips and valleys. The runners should run parallel to the edge of the sheeting and placed so as to permit the fixing of the sheets and hip covering accessories.

6.1.6 Laps

The plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) while laid fully, shall be with a side lap of one corrugation (see Fig. 1 and 2). Side laps of plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) when laid in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, shall be governed by the respective code of practice for laying asbestos cement/steel/aluminium sheets. When plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) are laid either fully or in conjunction with asbestos cement/steel/aluminium sheets on roof pitches above 10°, the side laps shall be stitch (seam) bolted at centres not exceeding 400 mm while on roof pitches below 10°, the centres shall be reduced to 300 mm. For normal roof pitches (that is,

inclinations greater than or equal to 18° , the end laps (see Fig. 3) of plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) with each other or with asbestos cement/steel/aluminium sheets shall not be less than 150 mm. For low roof pitches (that is inclinations less than 18°) or for normal pitched roof in exposed positions, the end laps shall be increased and the manufacturer shall be consulted in such cases. The side lap shall as far as possible, be sheltered from the prevailing wind direction. Side and end laps of plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) between themselves or between them and asbestos cement/steel/aluminium sheets shall always be sealed on roof pitches up to 18° using mastic sealant ensuring that sealant is correctly bedded into underlapping corrugation before laying over sheets. Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) shall not overhang supports at eaves (measured as the length of sheet from its lower edge to the centre of bolt holes) by more than 230 mm.

6.1.6.1 While laying roof fully with plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced), wherever four corners of sheets overlap, two of them shall be mitred in the manner described in Fig. 4, in order to secure a perfect fit. While plastic translucent sheets made from thermosetting polyester resin are laid in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, wherever

corners of plastic translucent sheets overlap with asbestos cement/steel/aluminium sheets, they should be mitred in the same fashion as required and laid down in the respective code of practice for laying asbestos cement/steel/aluminium sheets.

7 LAYING AND FIXING OF SHEETS

7.1 Sawing and Drillings

7.1.1 Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) shall be cut as necessary with a hacksaw with 6/8 teeth per centimeter. Best results are obtained if saw is held at a shallow oblique angle. When cutting with power tools, a 40/60 grit diamond blade operating at medium speed (280 surface m/min) shall be used. Sheets shall be notched using standard metal working snips. Holes in the sheets shall be drilled with standard metal bits. Holes shall not be punched. On sinusoidal profiles, holes shall always be drilled through the crown of the corrugation and not on the valley.

7.1.2 While plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) are laid either fully or in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, for end laps, holes in the plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) shall be drilled at a distance not less than 100 mm from the edge to suit the purlins, that is, on the centre line of the purlins if these are of timber and square head coach screws are

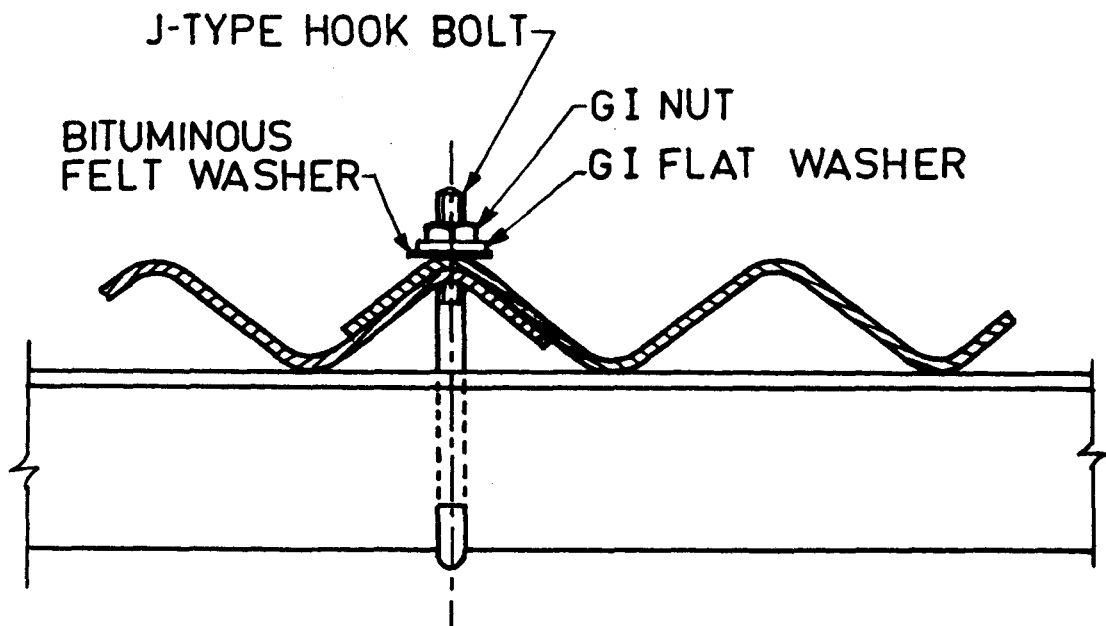


FIG. 1 TYPICAL SIDE LAP OF PLASTIC TRANSLUCENT SHEETS — CORRUGATED PROFILE

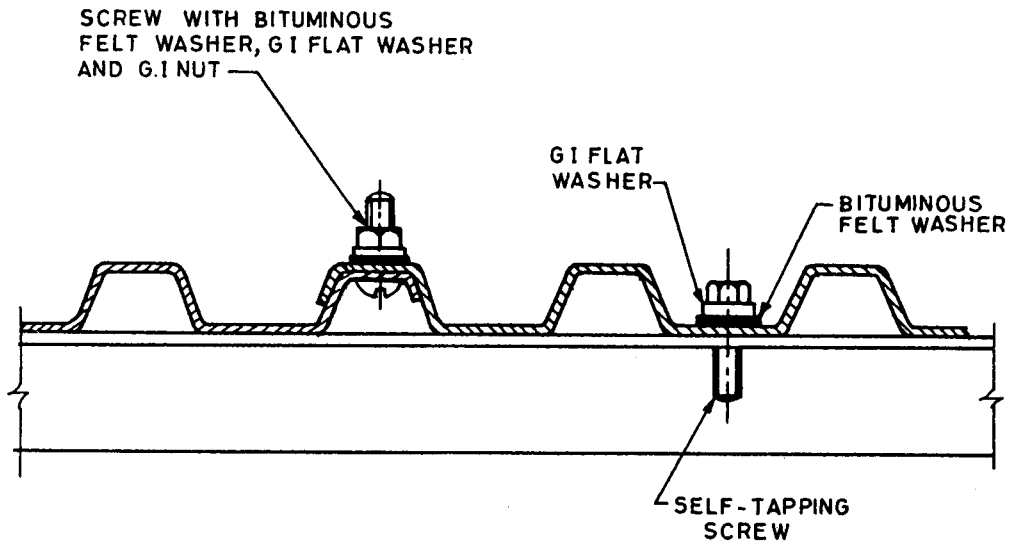


FIG. 2 TYPICAL SIDE LAP OF PLASTIC TRANSLUCENT SHEETS TROUGHED PROFILE

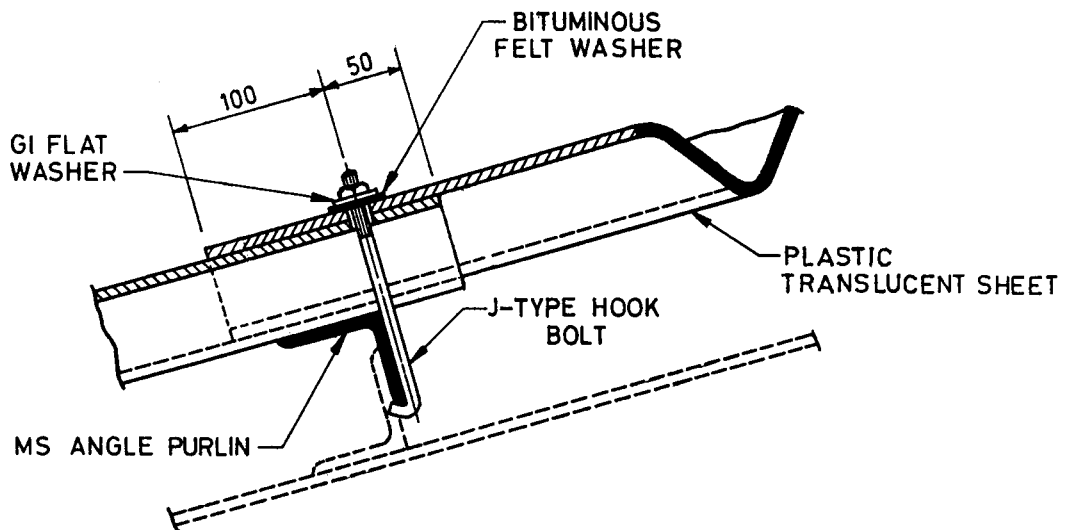


FIG. 3 DETAIL OF END LAP

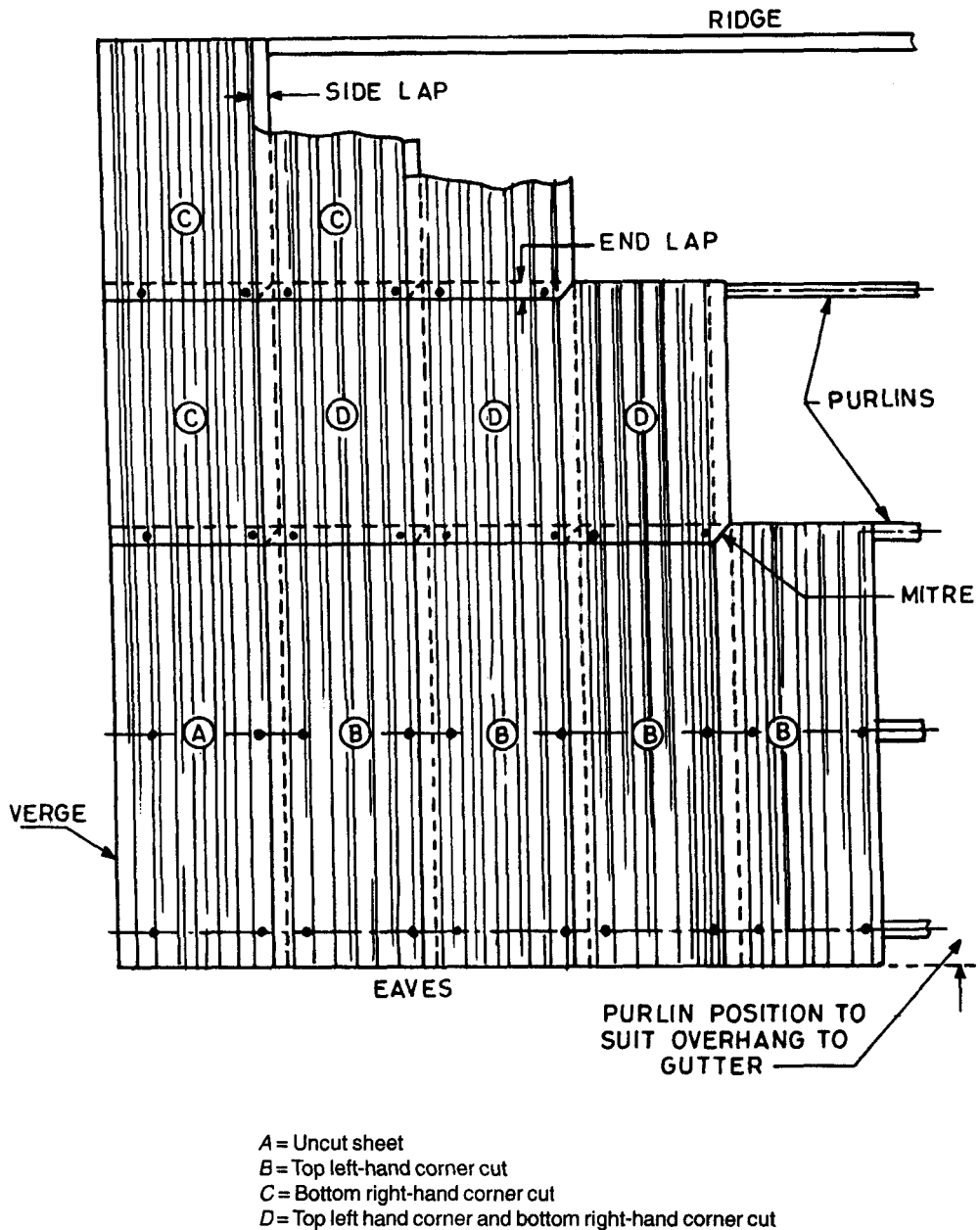


FIG. 4 LAYING OF SHEETS (SHEETS LAID FROM LEFT TO RIGHT)

used, or as close as possible to the back of the purlins if *J*- or *L*-bolts are used with steel angles or precast concrete or timber purlins. It is therefore, recommended to drill the holes on the roof with the sheeting laid in the correct position. No hole shall be nearer than 50 mm to any edge of a plastic translucent sheet made from thermosetting polyester resin (glass fibre reinforced).

7.2 Fixing Accessories

7.2.1 The satisfactory service of a roof largely depends upon determining the correct support centre and

efficiency of fixing accessories. The area of sheeting under the adjacent to a fixing washer is where most failures originate. The diameter of the washer is thus important. Also if fasteners are not fixed 'square on' to the sheets and washers are out of register, washer edges can impart a quilloting action on sheets causing failure at lower loads. Thus it is recommended to consider the factors specified in 7.2.1.1 to 7.2.1.3 while determining support centres and fixing specifications as well as accessories.

7.2.1.1 Sheets shall not pull over fasteners when subjected to high wind loads.

7.2.1.2 Deflections between supports caused by high wind gusts shall be limited to prevent fixing holes ovaling and tearing around fasteners.

7.2.1.3 Deflections shall be limited against sustained snow loads to prevent laps opening and damaging sealants.

7.2.2 Galvanized iron *J*-type hook bolts or cranked hook bolts, and nuts bearing on galvanized iron washers and bitumen washers shall be used for fixing sheets on angle iron purlins.

7.2.3 Galvanized iron *L*-type hook bolts and nuts bearing on galvanized iron washers and bitumen washers shall be used for fixing sheets on R.S. joist, precast concrete or timber purlins.

7.2.4 Galvanized iron coach screws bearing on galvanized iron washers and bitumen washers shall be used for fixing sheets on timber purlins.

7.2.5 Cadmium plated or stainless steel self-lapping screw bearing on cadmium plated or stainless steel washers and bitumen washers shall be used for fixing trough section profiles directly to the supporting structures through bottom flat troughs of sheets.

7.2.6 Galvanized iron roof bolts and nuts bearing on galvanized iron flat washer and bitumen washers shall be used for stitching on the sheets, fixtures like ridge capping, corner pieces, ventilators, north light curves, etc.

7.2.7 Where sheets are laid on tubular purlins, the fixing bolt should be designed to encompass at least half the tube periphery and precaution should be taken to prevent its rotation. Sections other than angles and tubes may require an adapted form of hook bolt.

7.2.8 It is essential that the bolt holes are made watertight by the use of bituminous felt washers in conjunction with suitable galvanized iron washers. These form essential accessories to good fixing work. Fixing bolts and screw shall be 8 mm or more in diameter and the nuts of the hook crank bolts (or heads of coach screws) shall bear on galvanized iron washers (flat, curved or diamond pattern) which, in turn, shall be embedded on bituminous felt washers (round or diamond pattern corresponding to the shape of galvanized iron washer). The screws or nut shall be tightened sufficiently only to seat the bitumen washer over the corrugations, so that natural movement in the substructure of the roof may not damage the sheeting.

7.2.9 While laying plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) of different profiles conforming to IS 12866, the number and length of *J*-bolts or crank bolts shall be as given in Table 3.

7.2.10 Number of galvanized iron roof bolts and number of bitumen and galvanized iron washers required for stitching the side laps of plastic

Table 3 Number and Length of Bolts and Number of Bituminous Felt and Galvanized Iron Washers
(Clause 7.2.9)

Situation	Type of Sheet	Profile No.	Overall Width	No. of Bolts and Bituminous Washers and Galvanized Iron Washers	Length of Bolt
(1)	(2)	(3)	(4)	(5)	(6)
At horizontal (end) laps of sheet. At eaves when filler pieces are used. At ridge when corrugated sheets and ridge pieces are secured by the same bolt	Corrugated asbestos cement profile in accordance with IS 459	1	1 050	Three times the number of sheets in one horizontal course	Depth of purlin plus 90 mm
	Corrugated steel profile in accordance with IS 277	3	660	Three times the number of sheets in one horizontal course	Depth of purlin plus 65 mm
	Corrugated aluminium sheets profile in accordance with IS 1254	5	650	Three times the number of sheets in one horizontal course	Depth of purlin plus 65 mm
			800	Four times the number of sheets in one horizontal course	Depth of purlin plus 65 mm

translucent sheets shall be in accordance with 6.1.6. Where plastic translucent sheets are laid in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, the number of galvanized iron bolts and number of bitumen and galvanized iron washers required for stitching the side laps shall be governed by the respective code of practice for asbestos cement/steel/aluminium sheets.

7.2.11 The galvanized iron flat washer shall generally be 29 mm in diameter and 1.6 mm thick with hole to suit the required size of fixing accessory. The bitumen washer shall be 40 mm in diameter and 1.5 mm thick with hole to suit the required size of fixing accessory. For other shapes of galvanized iron and bitumen washers, suitable sizes as approved by the engineer-in-charge may be used.

7.2.12 Ridge cappings shall, as far as possible, be secured to the ridge purlins by the same bolts which secure the sheeting. Other plastic translucent accessories such as barge boards, eaves filler pieces and apron flashing pieces shall be secured either to the supporting structure or to the sheeting by roofing bolts.

7.3 Laying the Sheets

7.3.1 When plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) are laid either fully or in chequerboard or eaves to ridge layouts in conjunction with asbestos cement/steel/aluminium sheets, before the actual laying of sheets are started, the purlin spacing and the length of the sheets shall be checked to ensure that the arrangement will provide the laps required and the specified overhang at the eaves.

7.3.2 When plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) are laid in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, the required total number of plastic translucent sheets shall be distributed over the entire roof area at equal pitch to ensure even daylight.

7.3.3 When the roof of a building is laid fully with plastic translucent sheets, the side of end laps of the sheets shall be in accordance with 6.1.6. When the roof of building is laid using plastic translucent sheets in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, the side and end laps of plastic translucent sheet with asbestos cement/steel/aluminium sheets shall be governed by the respective code of practice for laying asbestos cement/steel/aluminium sheets. In either case, the course of sheets shall be so laid that the corrugations run in continuous straight lines.

7.3.4 When a building in an exposed position and subject to driving winds and rains is being laid fully with plastic translucent sheets, it is advisable to commence laying the sheets from the end opposite to the direction of prevailing winds. When a building in an exposed position and subject to driving winds and rains is being laid with plastic translucent sheets in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, the laying of sheets should commence in the way as governed by the respective code of practice for laying asbestos cement/steel/aluminium sheets.

7.3.5 When the roof of a building is being fully laid with plastic translucent sheets, they shall start at the eaves either from left to right or from right to left depending upon the prevailing direction of the wind. If laid from left to right (*see* Fig. 4), the first sheet shall be laid uncut, but the remaining sheets in the bottom row shall have the top left-hand corners cut or mitred. The sheets in the second and other intermediate rows shall have the bottom right-hand corner of the first sheet cut, all other sheets except the last sheet shall have both the bottom right hand corner and top left hand corner cut; the last sheet shall have only the top left hand corner cut. The last or the top row sheets shall all have the bottom right hand corner cut with the exception of the last sheet which shall be laid uncut. If the sheets are laid from right to left, the first sheet shall be laid uncut and the remaining procedure shall be reversed. When plastic translucent sheets are laid in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, the procedure of laying the sheets shall be governed by the respective code of practice for laying asbestos cement/steel/aluminium sheets.

7.3.6 The mitre described in 7.3.5 is necessary to provide a snug fit where four sheets meet at a lap. It is cut from a point minimum 15 cm (or whatever the length of the end lap may be) up the vertical side of the sheet to a point 4.5 cm along the horizontal edge. This cutting shall be done with 6/8 teeth per cm at site.

7.3.7 When a roof is being fully laid with plastic translucent sheets, the end of sheets at the eaves shall be supported and the support shall be placed as near to the margin of the sheets as practicable. The maximum free overhang at the eaves shall be not more than the limits specified in 6.1.6. When plastic translucent sheets are laid in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, the maximum free overhang at the eaves shall be governed by the respective code of practice for laying asbestos cement/steel/aluminium sheets.

7.3.8 When a roof is being fully laid with plastic translucent sheets for sinusoidal profile plastic translucent sheets, fixings should be located through the crowns of the sheets. Trough section profile plastic translucent sheets should be fixed direct to the supporting structure with cadmium plated or stainless steel self tapping screws located in the bottom flat troughs of sheets, nuts or screws shall be tightened lightly at first, and then fully tightened when a dozen or more sheets have been laid. On no account shall the fixing screws or the nuts on fixing bolts be screwed down too tightly, and care shall be taken not to deflect sheets at the intermediate purlins in an attempt to make the sheets bear on such purlins. When sinusoidal profile plastic translucent sheets over 25 mm deep are fixed through the crowns, it is essential that shaped packing pieces are located between the sheet and supporting members to enable fixings to be correctly tightened without distorting the sheet profile.

8 FIXING OF ACCESSORIES

8.1 General

When a roof is being fully laid with plastic translucent sheets, required moulded plastic translucent accessories should be selected as far as possible from the range of standard patterns. Special plastic translucent fittings, if required, should be designed to conform closely to the sheet profile. When the use of moulded plastic translucent accessories is impracticable, other methods as approved by the engineer-in-charge may be employed. When a roof is being laid with plastic translucent sheets in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, the selection and fixing of asbestos cement/steel/

aluminium accessories shall be governed by the respective code of practice for laying asbestos cement/steel/aluminium sheets.

8.1.1 Plastic translucent roofing accessories should be secured to the roof as far as possible, by the same bolts which secure the sheets.

8.2 Ridge Capping

Plastic translucent ridge capping should be secured to the ridge purlins as far as possible by the same bolts which secure the sheets. Where this is not possible, each wing of the ridge capping should be adequately secured to the sheets by roofing bolts.

8.2.1 Close Fitting Adjustable Ridge Capping

The plastic translucent close fitting adjustable ridge capping shall be designed to fit the corrugations of standard plastic translucent corrugated sheets laid with a side lap of one corrugation, and shall be secured with the fixing accessories used to fasten the sheets to the ridge purlins (*see* Fig. 5). Correct positioning of plastic translucent sheets is necessary, and Fig. 6 illustrates how to fit each wing of the ridge when sheets are laid either from left to right or from right to left. Correct fitting of plastic translucent ridge capping will be automatic, if a template is used when fixing the plastic translucent roofing sheets.

8.2.1.1 While fitting plastic translucent close fitting adjustable ridge capping, the work shall be started from the left hand verge, placing first small roll wing (inner) and positioning it in such a way that the first valley on the right hand side of the ridge wing fits into the valley at side lap of roof sheeting. It may be necessary to leave a piece of ridge project beyond the verge whilst fitting and cut off the unrequired portion afterwards.

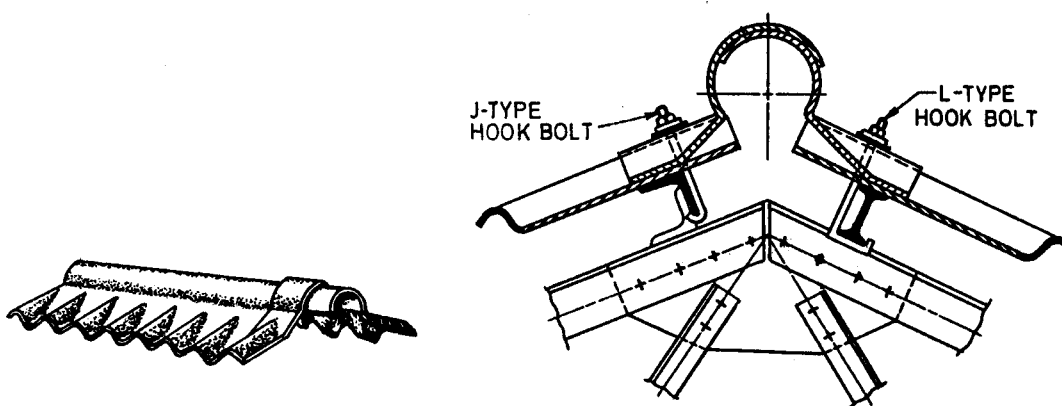
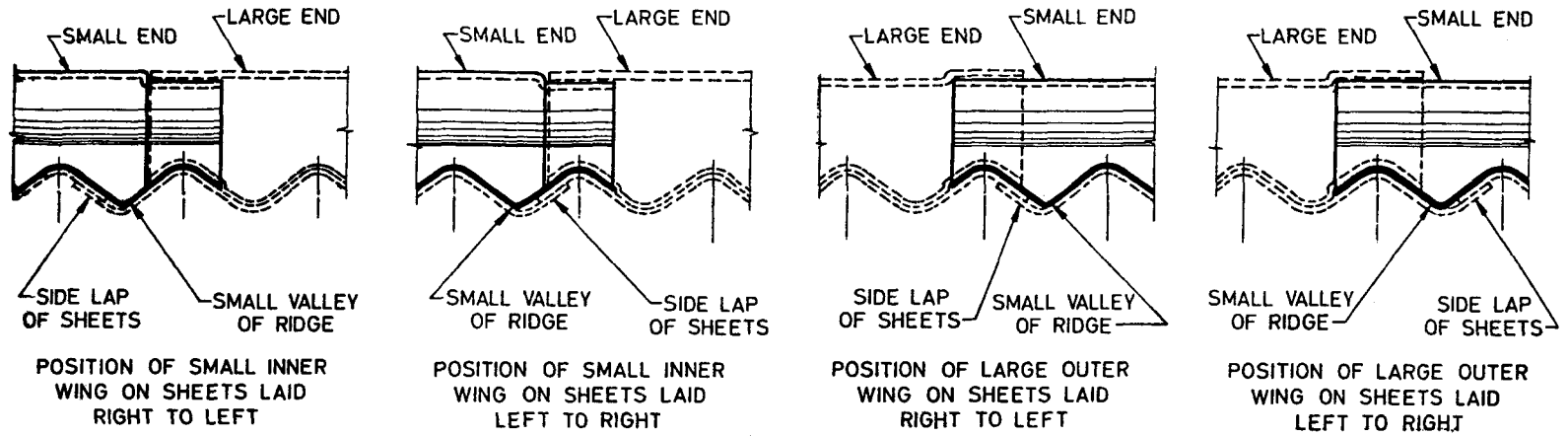


FIG. 5 TYPICAL CLOSE FITTING ADJUSTABLE RIDGE



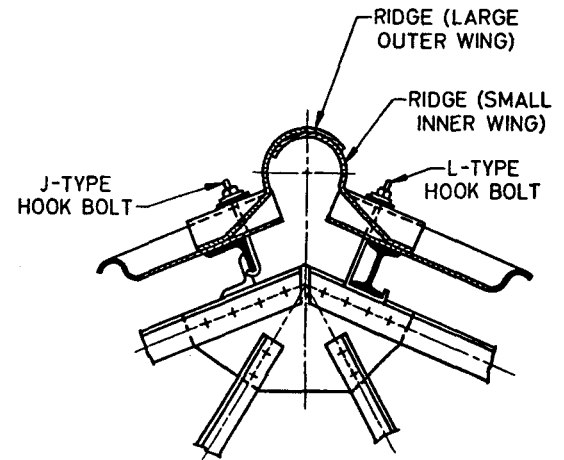
TEMPLATE FOR CORRECT GAUGING OF CORRUGATED SHEET SIDE LAP



SMALL VALLEY
LARGE OUTER WING



SMALL VALLEY
SMALL INNER WING



FIXING OF ADJUSTABLE RIDGE PIECES

FIG. 6 DETAILS SHOWING METHOD OF FIXING CLOSE FITTING ADJUSTABLE RIDGE PIECES

In the case of a large roll wing, the wing shall be positioned so that the first valley on the left hand side of the ridge wing fits into the valley at the side lap of the roof sheeting. The ridge wing shall be trimmed at verge to suit requirements.

8.2.2 Serrated Adjustable Ridge Capping

Plastic translucent serrated adjustable type ridge capping are supplied in pairs; the inner and outer being made easily distinguishable (see Fig. 7 and 8). These ridges have certain serrations suitably painted for distinction and, when fixing, these serrations shall be arranged at side lap joints of the sheets, in which case the stagger-lapping of the two wings of this ridge will be automatic. Figure 8A indicates the method of laying and fixing these ridges.

8.3 Ridge Finial

One-piece plastic translucent ridge finial should be secured by one roofing bolt through the crown. Two-piece ridge finial should be secured to the ridge capping and roof sheeting by one bolt through each wing of the fitting. In addition, they should be secured to the ridge capping by one roofing bolt at the crown (see Fig. 9).

8.4 Hip Capping or Hip Tiles

The plastic translucent roof sheeting at hips should be cut to the required mitre and be close butted. The hip joint may be covered with plastic translucent two-piece plain wing hip tiles (see Fig. 10), one-piece socketed plain wing angular hip tiles, or heavy half-

round hip tiles. Alternatively, an apron type of plastic translucent capping may be used for scribing on site, over the corrugations. Where the sub structure is of metal or concrete, the plain wing ridge should be secured through the roof sheets to the hip runners by one bolt on each side immediately above the socket. Each half-round hip tile should be secured with a single bolt at the centre, the bolt being secured at its lower end by a metal bridging plate whose ends bear on the underside of the sheeting. On a timber roof, the hip tile should be fixed to the rafter by means of coach screws.

8.5 Eaves, Verges and Gable Ends

Plastic translucent accessories may be used to close the corrugation at eaves (see Fig. 11) and at the bottom of vertical sheeting. Alternatively, plastic translucent sheeting at the eaves may be bedded in mortar if the walls of the building are of brick, block or similar construction.

8.6 Top Edges and Abutments

At top edges against walling, plastic translucent apron flashing pieces should generally be used (see Fig. 12). If the wall consists of vertical sheeting, it should lap over the upstand of the flashing piece and the apron should lap over the roof sheeting; no metal flashing is required. If, however, the wall is of brick or masonry, the apron should be secured to the sheeting and metal or felt cover flashing should be used over the upstand of the flashing piece.

At a sloping abutment, if the direction of the

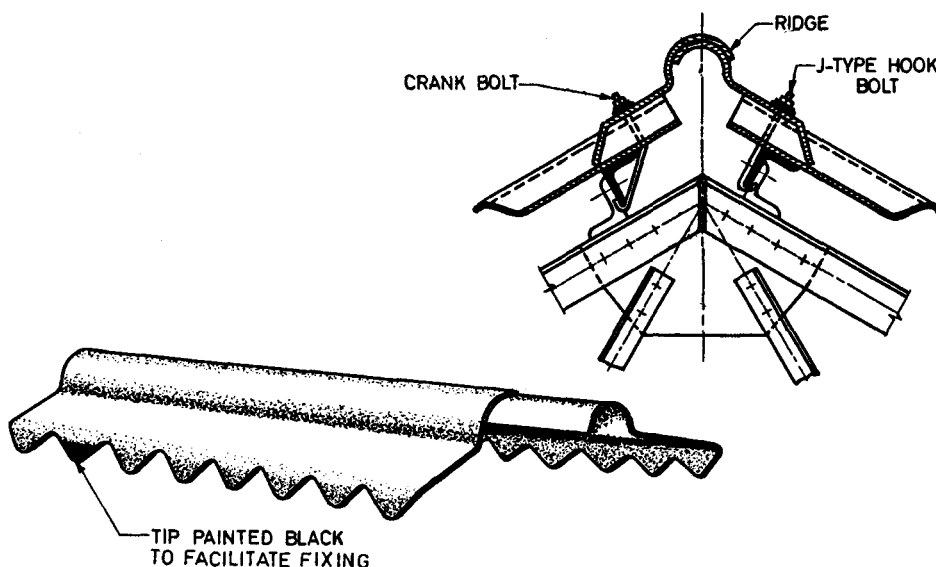


FIG. 7 TYPICAL SERRATED ADJUSTABLE RIDGES

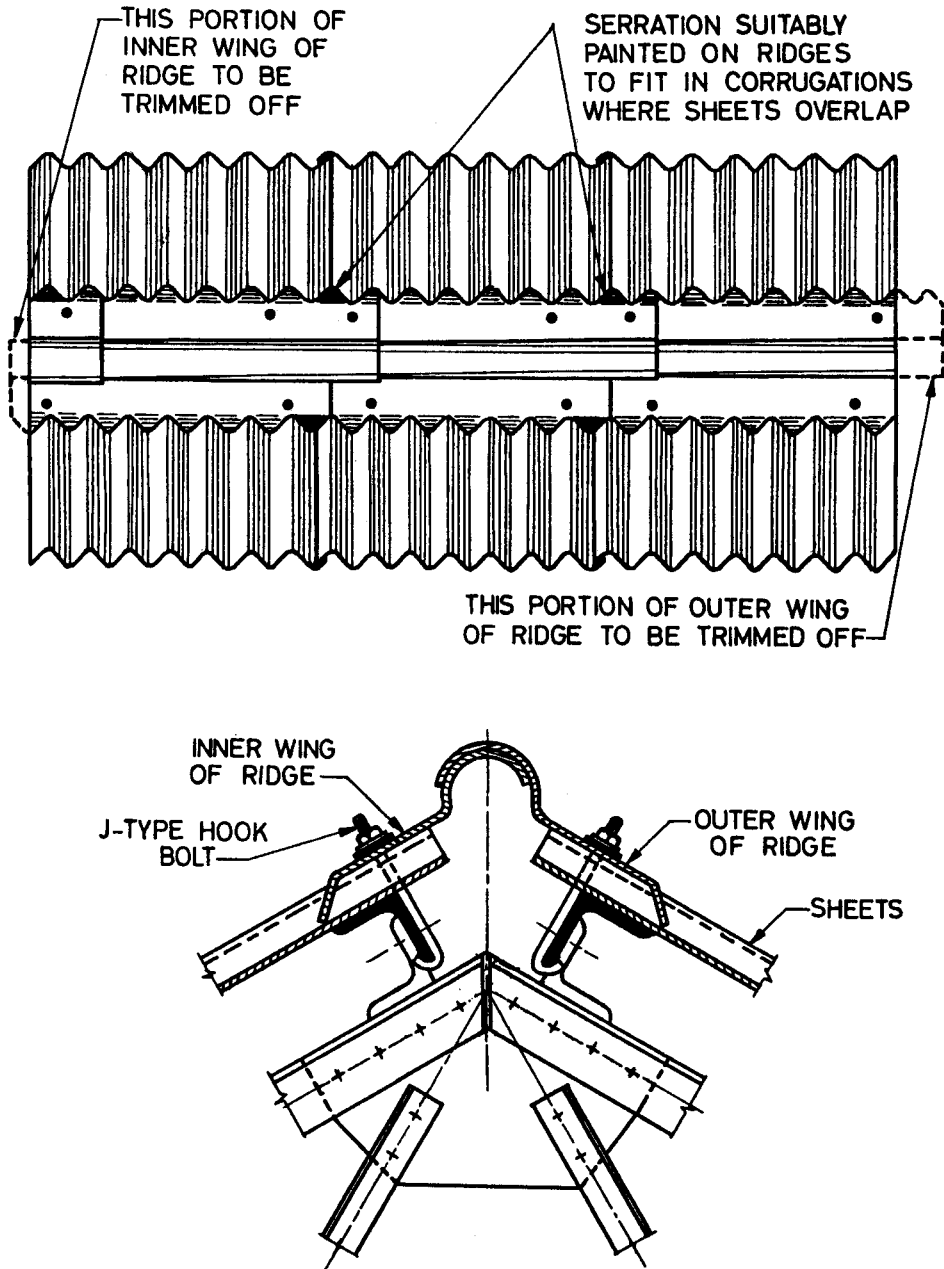


FIG. 8 DETAILS SHOWING FIXING OF SERRATED ADJUSTABLE RIDGES (SHEETS LAID FROM LEFT TO RIGHT)

corrugations is parallel to or running away from the wall face, metal or felt flashings may be used. The flashing should be dressed as an apron over the roof sheeting to cover atleast the first full corrugation of the sheeting and should be not less than 150 mm wide. The upstand should be provided with cover flashings or should be turned into and secured to the wall. If the corrugations run into the wall face, the edge of the sheeting should be kept back atleast 125 mm clear of the wall face and a suitable gutter should be provided.

8.7 Ventilators

When a roof is being laid fully with plastic translucent sheets, permanent ventilation through roofs may be affected by the use of specially purpose built moulded plastic translucent accessories which include continuous ridge ventilators, wing type ventilating ridge capping louver, louver ventilators, purpose made ventilators and extractors (see Fig. 13).

Alternatively, if a wide continuous ventilating space

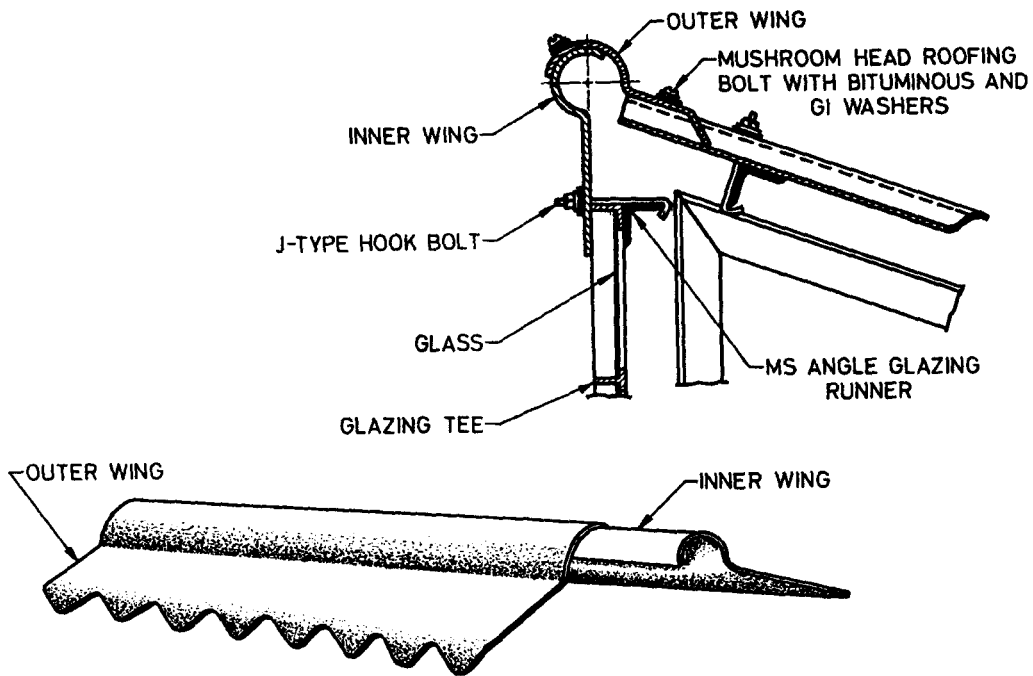


FIG. 8A TYPICAL NORTHLIGHT TWO-PIECE ADJUSTABLE RIDGE

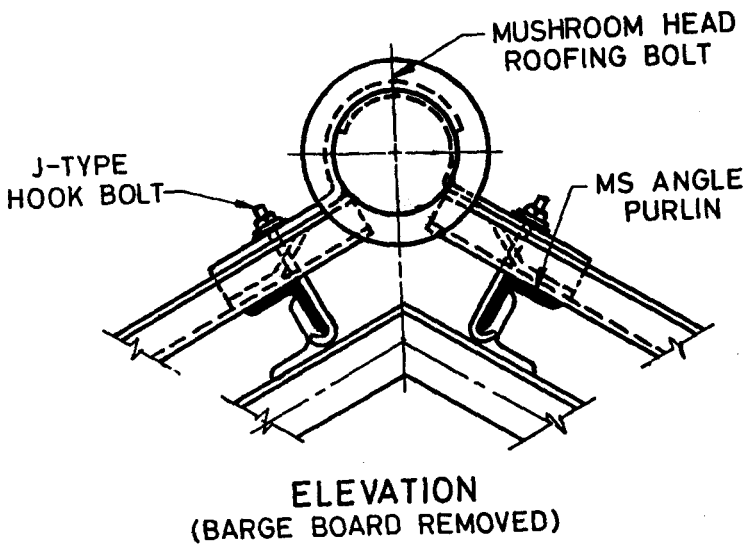
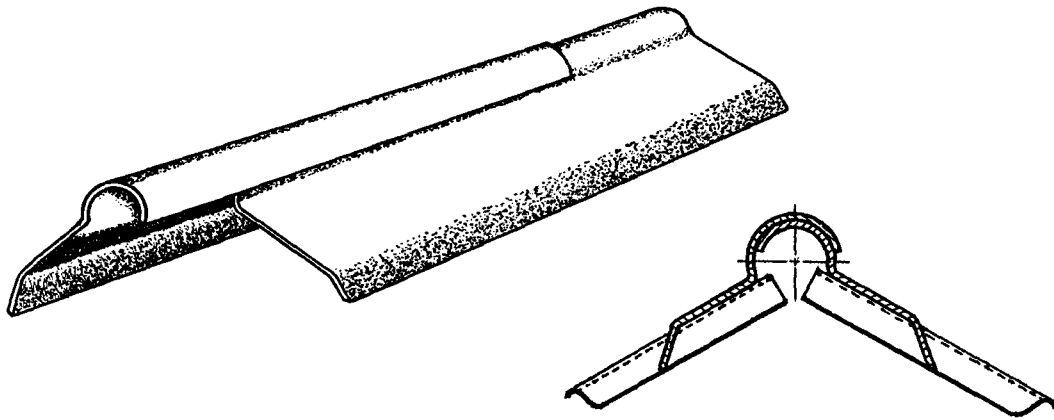


FIG. 9 TYPICAL RIDGE FINAL



NOTE — Serrations, as desired, should be cut at site to fit corrugations at hip slopes.

FIG. 10 TYPICAL UNSERRATED ADJUSTABLE RIDGE FOR HIP

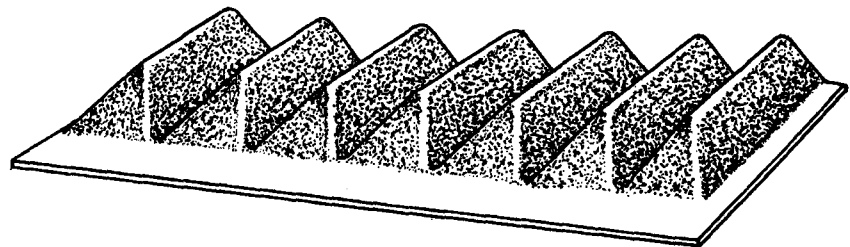
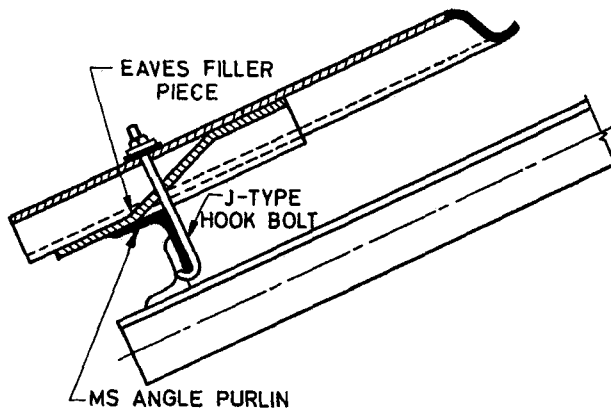


FIG. 11 TYPICAL EAVES FILLER PIECE

at the ridge is required, the normal type of ridge capping may be omitted, the upper course of plastic translucent roof sheets on each slope may have up-turned ends and the gap at the ridge may be roofed over at a higher level with segmental or down-curved sheets.

When plastic translucent sheets are laid in conjunction with asbestos cement/steel/aluminium sheets in

chequerboard or eaves to ridge layouts, permanent ventilation through roofs may be affected by the use of such specially moulded-fabricated asbestos cement/steel/aluminium accessories as described in the respective code of practice for laying asbestos cement/steel/aluminium sheets.

8.8 Other plastic translucent accessories such as corner rolls and barge boards (see Fig. 14) should be secured

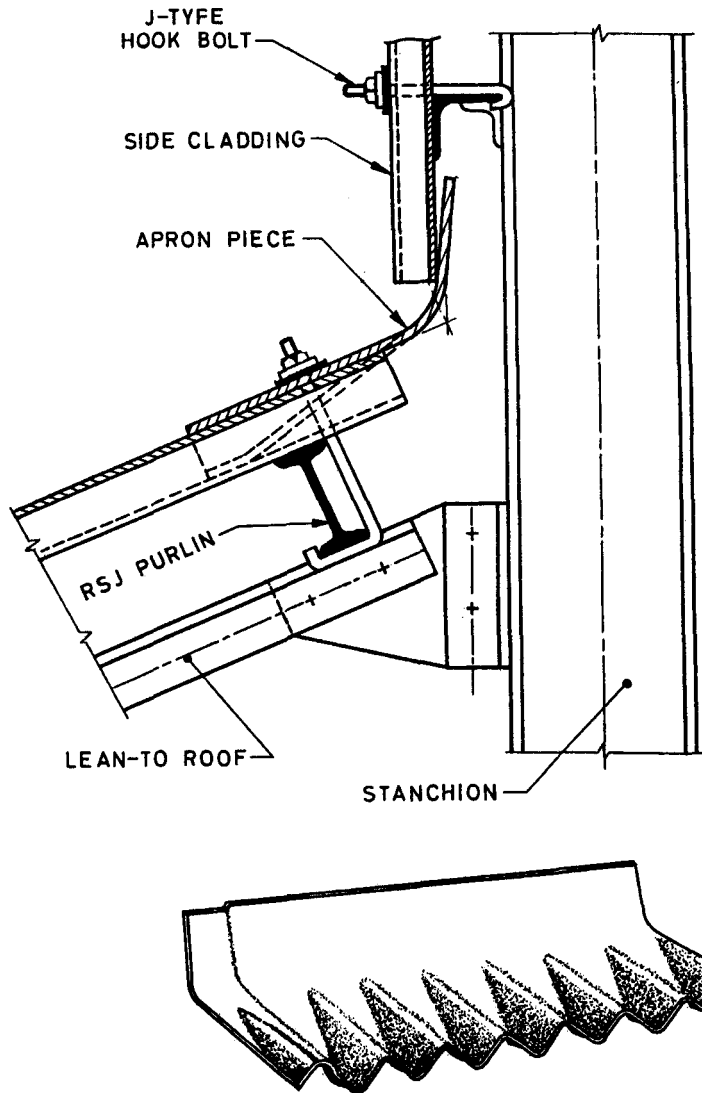


FIG. 12 CORRUGATED APRON PIECE

either to the structure or to the sheeting with the help of roofing bolts.

9 GUTTERS AND RAIN-WATER PIPES

9.1 Gutters and rain water pipes shall be fixed in accordance with the recommendations of relevant Indian Standard/Code of practice.

10 STORAGE AT SITE

10.1 All plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) shall be stored on flat clean battens laid on firm level ground at centres not exceeding 1 500 mm. Stack heights should not exceed 1 000 mm.

10.2 Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) shall be protected from wind against being blown away

and mechanical damage. When stored in open, they should always be covered with water-proof covers. Otherwise, the sun's rays passing through layers of translucent sheets act as a 'solar battery', boiling any entrapped moisture, and this can discolour sheets.

11 HANDLING AND SAFETY PRECAUTIONS

11.1 When handling long lengths of plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced), several sheets nested together shall be carried with a man supporting sheets every 3 000 mm to prevent breakage. Single sheets can be carried by rolling sheets across their width to form a cylinder, and roping at 1 500 mm interval.

11.2 Walking on plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) shall not be allowed. Crawling boards/roof boards must be used by men working on the roofs.

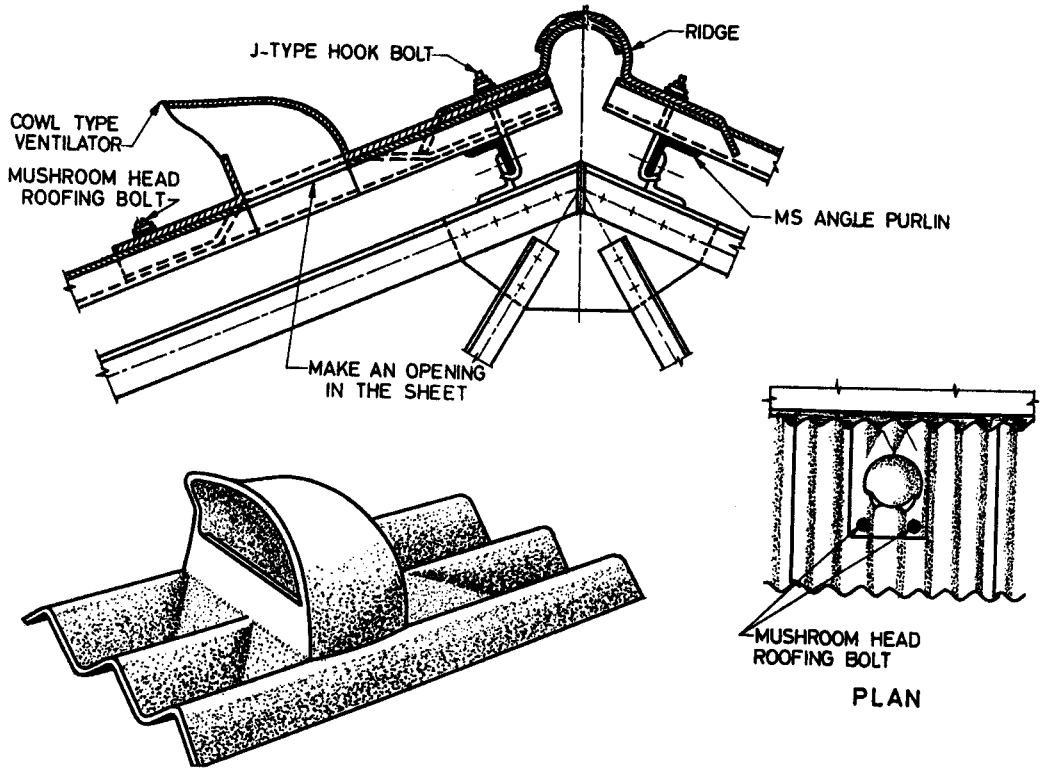


FIG. 13 TYPICAL CORRUGATED COWL TYPE VENTILATOR

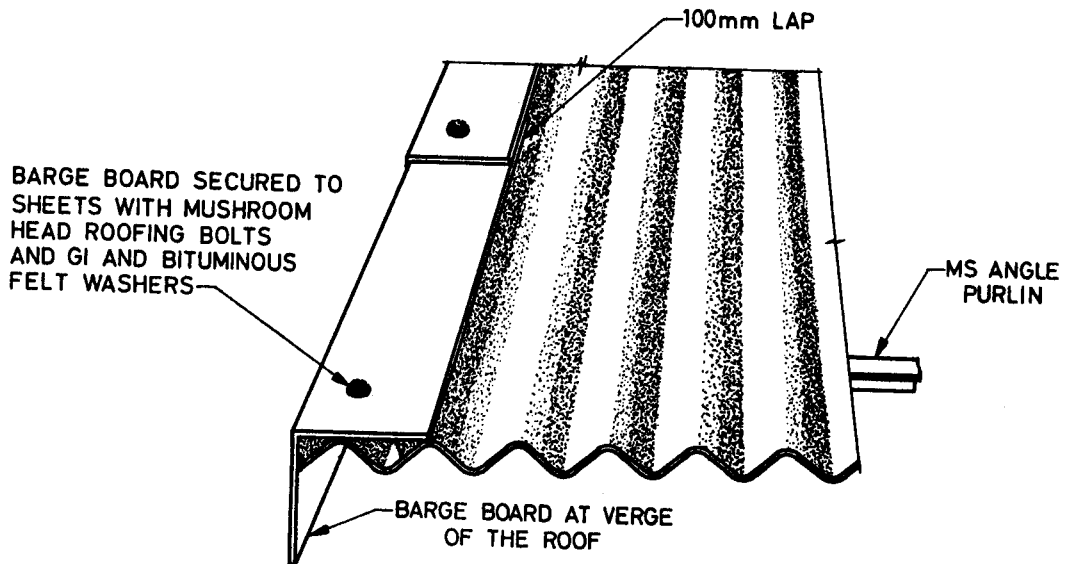


FIG. 14 TYPICAL DETAILS OF BARGE BOARD OR CORNER (VIEW FROM EAVES)

11.3 All other safety precautions shall be observed in accordance with the provisions laid down in the respective codes of practice for laying asbestos cement/steel/aluminium sheets.

12 CLEANING AND MAINTENANCE

12.1 When a roof is being laid either fully with plastic translucent sheet or using plastic translucent sheets in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts to maintain the designed daylight factors, plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) shall be periodically cleaned with warm water and mild detergent. Persistent stains shall be removed by gently rubbing with a bristle brush. Tar or grease deposited from industrial atmospheres shall be removed with white spirit or acetone solvent.

12.2 To maintain sheet appearance, clean and dry

plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced) may be painted with clear, water white air drying lacquer.

12.3 Small holes or tears in plastic translucent sheet made from thermosetting polyester resin (glass fibre reinforced) may be patched with same grade of unsaturated polyester resin and glass fibre chopped strand mat by using which the sheet was originally made.

12.4 All fixings shall be periodically inspected and renewed or retightened as necessary.

12.5 When plastic translucent sheets are laid in conjunction with asbestos cement/steel/aluminium sheets in chequerboard or eaves to ridge layouts, all other aspects of maintaining the roof covering shall be in accordance with the procedures laid down in the respective codes of practice for laying asbestos cement/steel/aluminium sheets.

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
277 : 1992	Galvanized steel sheet (plain and corrugated) — Specification (<i>fifth revision</i>)	1120 : 1975	Specification for coach screws (<i>first revision</i>)
459 : 1992	Corrugated and semi corrugated asbestos cement sheets — Specification (<i>third revision</i>)	1254 : 1991	Corrugated aluminium sheet — Specification (<i>third revision</i>)
730 : 1978	Specification for hook bolts for corrugated sheets roofing (<i>second revision</i>)	12866 : 1989	Specification for plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced)

ANNEX B

(Foreword)

COMMITTEE COMPOSITION

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Engineer-in-Chief's Branch, Army Headquarters, New Delhi	SHRIMATI UPINDER KAUR SHRIMATI RIVOO MAHINDRU (<i>Alternate</i>)
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National Test House, Kolkata	SHRI D. K. KANUNGO SHRI R. KAPOOR (<i>Alternate</i>)
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Projects & Development India Limited, Sindri	DR P. K. JAISWAL SHRI A. K. PAL (<i>Alternate</i>)
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(Continued on page 19)

(Continued from page 18)

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Amendments Issued Since Publication

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